Title: Logical Reasoning Systems
AIMA: Chapter 10 (Sections XXX)

Introduction to Artificial Intelligence
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Agents: explicitly represent and reason with knowledge
$\longrightarrow$ Knowledge (KB) and the control (inference) are kept separate

Automated reasoning systems:

1. Theorem provers (Logic Programming)
2. Production systems
3. Frame systems and semantic networks
4. Description Logic Systems

Theorem provers (Logic Programming)

use resolution (or other complete inference procedure) to prove sentences in FOL, often for mathematical and scientific reasoning tasks.

- Answer a question: Prove a sentence containing a variable by instantiating the variable.
- Usually use a backward-chaining mechanism
- Example of logic programming language: Prolog

Production Systems

Primary representation: implications (if-then rules)

- Consequences are action recommendation (not a logical conclusion)
  Consequences are added to KB, removed from KB..
- Usually, use a forward-chaining mechanism
- Example: OPS-5, Clips

Frame systems and Semantic Networks

Objects are nodes in a graph

Nodes are organized in a taxonomic structure (classification)

Links between nodes represent binary relations

Frame:

each object (box) has a list of slots, or attributes

each attribute is filled by another object (nested box) objects are organized in a classification hierarchy

Semantic network:

each object is a node

relation between nodes are annotated arcs

Description logic systems

- Evolved from an effort to formalize Semantic networks (using a subset of FOL)
- Stresses the taxonomic structure as an organizing principle
- Motivated by the need address both objects and classes and reason with
  – theirs definitions and
  – relations among them
- Trade-offs full expressiveness of FOL for gain in computational complexity